

REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 1-8 are pending in the present application. Claims 1-8 are maintained by the present amendment.

In the outstanding Office Action, the drawings were objected to; Claims 1, 2, 5, and 7 were rejected under 35 U.S.C. § 103(a) as unpatentable over Majumdar et al. (U.S. Patent No. 5,703,399, herein "Majumdar") in view of Wensel (U.S. Patent No. 5,959,349); Claim 3 was rejected under 35 U.S.C. § 103(a) as unpatentable over Majumdar, Wensel, and Tanaka et al. (U.S. Patent No. 5,293,301, herein "Tanaka"); and Claims 4, 6, and 8 were indicated as allowable if rewritten in independent form.

Applicant thanks the Examiner for the indication of allowable subject matter. However, Applicant believes that pending independent Claim 1 patentably distinguishes over the applied art. Accordingly, Claims 4, 6, and 8 are maintained in dependent form. Further, Applicant thanks the Examiner for the courtesy of an interview extended to Applicant's representative on April 5, 2004. During the interview differences between the pending claims and the applied art were discussed. No agreement was reached pending the Examiner's further review of a filed response. Arguments presented during the interview are reiterated below.

Regarding the objection to the drawings, Figures 8-10 are labeled "Background Art" as suggested in the outstanding Office Action. Formal drawings including those labels are filed with this response. Accordingly, it is respectfully submitted that this objection be withdrawn.

Claims 1, 2, 5, and 7 were rejected under 35 U.S.C. § 103(a) as unpatentable over Majumdar in view of Wensel. That rejection is respectfully traversed.

As previously discussed, independent Claim 1 is directed to a semiconductor device having a semiconductor element, a lead frame, a metal block, an insulation layer, and a bonding material. The lead frame has a first surface on which the semiconductor element is mounted and a second surface opposite to the first surface. The metal block is on the second surface of the lead frame and the insulation layer is on the metal block opposite to the lead frame. The bonding material is between the second surface of the lead frame and the metal block and has a better heat conduction than the insulation layer. In a non-limiting example, Figure 1 shows the semiconductor element 1, the lead frame 2a, the metal block 5, the insulation layer 7, and the bonding material 10.

The present invention advantageously provides good heat dissipation from the metal block because of the good heat conduction of the bonding material positioned near the semiconductor element, which is a heat source.¹

Turning to the applied art, Majumdar shows in Figure 13 a semiconductor element 4a, a lead frame 3, a heat sink 1, and a highly heat conducting resin 2 interposed between the lead frame 3 and the heat sink 1. However, because Majumdar does not teach or suggest an element corresponding to the insulation layer recited in Claim 1, a magnitude relation between the highly heat conducting resin 2 of Majumdar and the insulation layer recited in pending Claim 1 cannot be derived from Majumdar.

Wensel discloses that a metal such as copper and aluminum are included in a dam 228 shown in Figure 5, and the dam 228 has higher heat conductivity than a packaging compound material 224.² However, because Wensel does not teach or suggest an element corresponding

¹ Specification, page 7, lines 13-15.

² Wensel, column 5, lines 60-63.

to the bonding material recited in Claim 1, a magnitude relation between the dam 228 and the bonding material recited in pending Claim 1 cannot be derived from Wensel.

Further, assuming that one of ordinary skill in the art would incorporate the dam 228 of Wensel into the device of Majumdar as asserted in the outstanding Office Action at page 3, lines 7-9, Applicant respectfully submits that one of ordinary skill in the art would not be able to obtain a semiconductor device including “a bonding material [that] has a higher heat conduction than said insulation layer,” as recited in Claim 1.

Moreover, when the heat conductivity of the dam 228 is improved by including metal such as copper and aluminum, it causes the problem of reduction in insulating properties of the dam 228.

Accordingly, it is respectfully submitted that independent Claim 1 and each of the claims depending therefrom patentably distinguish over the combination of Majumdar and Wensel.

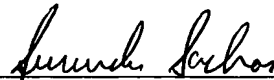
Claim 3 was rejected under 35 U.S.C. § 103(a) as unpatentable over Majumdar in view of Wensel and Tanaka. That rejection is respectfully traversed.

The outstanding Office Action relies on Tanaka for disclosing a semiconductor device including a metal block with a wider surface than a bonding material. However, Tanaka does not cure the deficiencies of Majumdar and Wensel discussed above. In addition, Claim 3 depends from independent Claim 1, which is believed to be allowable as noted above. Accordingly, it is respectfully submitted that dependent Claim 3 is also allowable.

Consequently, in light of the above discussion, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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